PALM INTRANET

Day : Thursday
Date: 11/20/2003
Time: 12:29:09

Inventor Name Search Result

Your Search was:

Last Name = KROGH
First Name = OLE

Application#	Patent#	Status	Date Filed	Title	Inventor Name 11
10189930	Not Issued	030	07/03/2002	METHOD AND APPARATUS FOR POLY GATE CD CONTROL	KROGH, OLE
10056299	Not Issued	030	01/23/2002	CLEANING PROCESS RESIDUES ON A PROCESS CHAMBER COMPONENT	KROGH, OLE
08529289	Not Issued	161	09/15/1995	ECR PLASMA SOURCE	KROGH , OLE D.
08331916	5453125	150	10/31/1994	ECR PLASMA SOURCE FOR GAS ABATEMENT	KROGH , OLE D.
08198524	5451259	150	02/17/1994	ECR PLASMA SOURCE FOR REMOTE PROCESSING	KROGH , OLE D.
07434197	4960610	150	11/13/1989	METHOD OF TREATING SEMICONDUCTOR WAFERS IN A MAGNETICALLY CONFINED PLASMA AT LOW PRESSURE BY MONITORING PEAK TO PEAK VOLTAGE OF THE PLASMA	KROGH , OLE
07421874	Not Issued	163	10/16/1989	POLYSILICON ETCH USING BROMINE	KROGH , OLE
07377808	Not Issued	161	07/10/1989	PROCESS FOR ETCHING ALUMINUM IN A PLASMA	KROGH , OLE D.
07267193	4949670	150	11/04/1988	METHOD AND APPARATUS FOR LOW PRESSURE PLASMA	KROGH , OLE
07110895	Not Issued	163	10/20/1987	REAL-TIME SPECTROSCOPIC ANALYSIS	KROGH , OLE D.
07063872	Not Issued	166	06/19/1987	PROCESS FOR ETCHING ALUMINUM IN A PLASMA	KROGH , OLE D.

Inventor Search Completed: No Records to Display.

WEST Search History

DATE: Thursday, November 20, 2003

Set Name side by side	Query	Hit Count	Set Name result set
	DB=USPT,PGPB,JPAB,EPAB,DWPI,TDBD; PLUR=YES; OP=ADJ		
L17	l13 and chuck	14	L17
L16	l13 and (electrostatic chuck)	3	L16
L15	L14 and holes	10	L15
L14	L13 and passing	21	L14
L13	L12 and ((non-reactive gas) or (innert gas) or nitrogen)	58	L13
L12	L11 and nitric	79	L12
L11	L10 and hydrofluoric	334	L11
L10	L9 and acid	851	L10
L9	L8 and cleaning	4469	L9
L8	processing chamber	18472	L8
L7	4491496.pn.	2	L7
L6	4491946.pn.	2	L6
L5	5549802.pn.	2	L5
L4	5549802.pn	0	L4
L3	6216710.pn.	3	L3
L2	6216710.pn. 5549802.pn. 4491946.pn.	0	L2
L1	5660640.pn.	2	L1

END OF SEARCH HISTORY

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Search Results - Record(s) 1 through 3 of 3 returned.

1. Document ID: US 20030150476 A1

L16: Entry 1 of 3 File: PGPB Aug 14, 2003

PGPUB-DOCUMENT-NUMBER: 20030150476
PGPUB-FILING-TYPE: new
DOCUMENT-IDENTIFIER: US 20030150476 A1

TITLE: Method of cleaning component in plasma processing chamber and method of producing semiconductor devices

PUBLICATION-DATE: August 14, 2003

INVENTOR-INFORMATION:

NAME	CITY	STATE	COUNTRY	RULE-47
Suzuki, Katsunori	Mihama-ku		JP	

US-CL-CURRENT: 134/1

ABSTRACT:

A component having small holes, such as a silicon electrode plate having gas nozzles, used in a plasma processing apparatus is cleaned by producing a cavitation zone that extends through an entire depth of the holes so that deposited layers on the inner walls of the holes formed during the use in the apparatus are removed. The cleaned component can subsequently be re-used in the apparatus, and the production cost and the consumption of natural resources are decreased.

Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | Claims | KWIC | Draw Desc | Image

2. Document ID: US 20030136428 A1

L16: Entry 2 of 3 File: PGPB Jul 24, 2003

PGPUB-DOCUMENT-NUMBER: 20030136428
PGPUB-FILING-TYPE: new
DOCUMENT-IDENTIFIER: US 20030136428 A1

TITLE: Cleaning process residues on a process chamber component

PUBLICATION-DATE: July 24, 2003

INVENTOR-INFORMATION:

NAME	CITY	STATE	COUNTRY	RULE-47
Krogh, Ole	Belmont	CA	US	

US-CL-CURRENT: 134/28; 134/30, 134/41

ABSTRACT:

A method of cleaning process residues from the surface of a substrate processing

chamber component having holes. In the method, the component is at least partially immersed into a cleaning solution comprising hydrofluoric acid and nitric acid, and a non-reactive gas is passed through the holes to prevent the cleaning solution from back-flowing into the holes during the cleaning process. The method is particularly useful for cleaning sputtering residue deposits from an electrostatic chuck used in a sputtering process.

Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | Claims | KWIC | Draw Desc | Image

3. Document ID: WO 2003061859 A1 US 20030136428 A1

L16: Entry 3 of 3 File: DWPI Jul 31, 2003

DERWENT-ACC-NO: 2003-709897
DERWENT-WEEK: 200367
COPYRIGHT 2003 DERWENT INFORMATION LTD
TITLE: Process residues cleaning method, involves partially immersing electrostatic chuck component into cleaning, and passing non-reactive gas through holes at high pressure

INVENTOR: KROGH, O

PRIORITY-DATA: 2002US-0056299 (January 23, 2002)

PATENT-FAMILY:

PUB-NO	PUB-DATE	LANGUAGE	PAGES	MAIN-IPC
WO 2003061859 A1	July 31, 2003	E	000	B08B003/04
US 20030136428 A1	July 24, 2003		006	B08B003/04

INT-CL (IPC): B08 B 3/04; B08 B 3/08; C23 C 16/44

Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | Claims | KWIC | Draw Desc | Image

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Term	Documents
ELECTROSTATIC	249421
ELECTROSTATICS	1632
CHUCK	87273
CHUCKS	14465
(13 AND (ELECTROSTATIC ADJ CHUCK)).USPT,PGPB,JPAB,EPAB,DWPI,TDBD.	3
(L13 AND (ELECTROSTATIC CHUCK)).USPT,PGPB,JPAB,EPAB,DWPI,TDBD.	3

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Search Results - Record(s) 11 through 14 of 14 returned.

11. Document ID: US 20030020928 A1

L17: Entry 11 of 14 File: PGPB Jan 30, 2003

PGPUB-DOCUMENT-NUMBER: 20030020928
PGPUB-FILING-TYPE: new
DOCUMENT-IDENTIFIER: US 20030020928 A1

TITLE: Methods and apparatus for processing microelectronic workpieces using metrology

PUBLICATION-DATE: January 30, 2003

INVENTOR-INFORMATION:

NAME	CITY	STATE	COUNTRY	RULE-47
Ritzdorf, Thomas L.	Kalispell	MT	US	
Eudy, Steve L.	Kalispell	MT	US	
Wilson, Gregory J.	Kalispell	MT	US	
McHugh, Paul R.	Kalispell	MT	US	
Weaver, Robert A.	Kalispell	MT	US	
Aegerter, Brian	Kalispell	MT	US	
Dundas, Curt	Kalispell	MT	US	
Peace, Steven L.	Kalispell	MT	US	

US-CL-CURRENT: 356/630

ABSTRACT:

A method and apparatus for processing a microelectronic workpiece using metrology. The apparatus can include one or more processing or transport units, a metrology unit, and a control unit coupled to the metrology unit and at least one of the processing or transport units. The control unit can modify a process recipe or a process sequence of the processing unit based on a feed forward or a feed back signal from the metrology unit. The control unit can also provide instructions to the transport unit to move the workpiece to a selected processing unit. The processing unit can include, inter alia, a seed layer deposition unit, a process layer electrochemical deposition unit, a seed layer enhancement unit, a chemical mechanical polishing unit, and/or an annealing chamber arranged for sequential processing of a workpiece. The processing units can be controlled as an integrated system using one or more metrology units, or a separate metrology unit can provide input to the processing units.

Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | Claims | KWIC | Draw Desc | Image

12. Document ID: US 6619304 B2

L17: Entry 12 of 14 File: USPT Sep 16, 2003

US-PAT-NO: 6619304
DOCUMENT-IDENTIFIER: US 6619304 B2

TITLE: Pressure chamber assembly including non-mechanical drive means

DATE-ISSUED: September 16, 2003

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Worm; Steven Lee	Raleigh	NC		

US-CL-CURRENT: 134/140; 134/147, 134/157, 310/46

ABSTRACT:

A pressure chamber assembly for processing a substrate includes a pressure vessel defining an enclosed pressure chamber. A substrate holder is disposed in the pressure chamber and is adapted to hold the substrate. A drive assembly is operable to move the substrate holder. The drive assembly includes a first drive member connected to the substrate holder for movement therewith relative to the pressure vessel and a second drive member fluidly isolated from the first drive member and the pressure chamber. A drive unit is operable to move the second drive member. The drive unit is fluidly isolated from the first drive member and the pressure chamber. The second drive member is non-mechanically coupled to the first drive member such that the drive unit can move the substrate holder via the first and second drive members.

42 Claims, 29 Drawing figures
Exemplary Claim Number: 14
Number of Drawing Sheets: 23

Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | Claims | KWIC | Draw Desc | Image

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13. Document ID: US 6127279 A

L17: Entry 13 of 14 File: USPT Oct 3, 2000

US-PAT-NO: 6127279
DOCUMENT-IDENTIFIER: US 6127279 A

TITLE: Solution applying method

DATE-ISSUED: October 3, 2000

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Konuma; Toshimitsu	Kanagawa			JP

US-CL-CURRENT: 438/745; 257/E21.251, 257/E21.309, 257/E21.313, 438/753

ABSTRACT:

In etching using an etching solution, irradiating ultraviolet light is irradiated into a resist patterned on an etching substrate or a film formed on the etching substrate and then an etching solution is applied to the etching substrate while rotating the etching substrate. Also, ozone water is applied in contact with the resist and then an etching solution is applied to the etching substrate while rotating the etching substrate. In crystallization using a metal element such as nickel for promoting crystallization of silicon, irradiating ultraviolet light is irradiated into a resist patterned on an substrate or a film formed on the substrate and then a nickel solution is applied to the substrate while rotating the substrate. Also, ozone water is applied in contact with the resist and then the nickel solution is applied to the substrate while rotating the substrate.

11 Claims, 15 Drawing figures
Exemplary Claim Number: 1
Number of Drawing Sheets: 6

Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | Claims | KWIC | Draw Desc | Image

☐ 14. Document ID: WO 2003061859 A1 US 20030136428 A1

L17: Entry 14 of 14 File: DWPI Jul 31, 2003

DERWENT-ACC-NO: 2003-709897
DERWENT-WEEK: 200367

TITLE: Process residues cleaning method, involves partially immersing electrostatic chuck component into cleaning, and passing non-reactive gas through holes at high pressure

INVENTOR: KROGH, O

PRIORITY-DATA: 2002US-0056299 (January 23, 2002)

PATENT-FAMILY:

PUB-NO	PUB-DATE	LANGUAGE	PAGES	MAIN-IPC
WO 2003061859 A1	July 31, 2003	E	000	B08B003/04
US 20030136428 A1	July 24, 2003		006	B08B003/04

INT-CL (IPC): B08 B 3/04; B08 B 3/08; C23 C 16/44

Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | KWIC | Draw Desc | Image

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Term	Documents
CHUCK	87273
CHUCKS	14465
(13 AND CHUCK).USPT,PGPB,JPAB,EPAB,DWPI,TDBD.	14
(L13 AND CHUCK).USPT,PGPB,JPAB,EPAB,DWPI,TDBD.	14

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L15: Entry 1 of 10 File: PGPB Aug 14, 2003

DOCUMENT-IDENTIFIER: US 20030150476 A1
TITLE: Method of cleaning component in plasma processing chamber and method of producing semiconductor devices

Abstract Paragraph (1):
A component having small holes, such as a silicon electrode plate having gas nozzles, used in a plasma processing apparatus is cleaned by producing a cavitation zone that extends through an entire depth of the holes so that deposited layers on the inner walls of the holes formed during the use in the apparatus are removed. The cleaned component can subsequently be re-used in the apparatus, and the production cost and the consumption of natural resources are decreased.

Summary of Invention Paragraph (5):
[0003] This invention relates to a method of cleaning a component in a processing chamber of a plasma processing apparatus used in the production of semiconductor devices, and to a method of producing semiconductor devices utilizing the cleaning method.

Summary of Invention Paragraph (7):
[0005] Plasma processing apparatus are widely used in production of semiconductor devices. In particular, plasma processing apparatus having a processing chamber provided with parallel-plate electrodes is generally used in dry etching and chemical vapor deposition (CVD). In such plasma processing apparatus, an electrode facing a semiconductor wafer, which forms one of the parallel-plate electrodes, is used as an essential component in the processing chamber.

Summary of Invention Paragraph (9):
[0007] FIG. 1 is a schematic cross-sectional view of a dry etching apparatus, which is an example of the plasma processing apparatus, used to etch silicon oxide films. A lower electrode 109 having an electrostatic chuck 108 to support a semiconductor wafer 107 is positioned at the bottom of a processing chamber, or a reaction chamber, 200. An upper electrode (a counter electrode) 100 facing the wafer 107 placed on the lower electrode 109 is positioned in a housing 111 at the top of the processing chamber 200. The upper electrode 100 and the lower electrode 109 constitute parallel-plate electrodes. A region between the parallel plate electrodes functions as a processing zone, or a reaction zone, 106.

Summary of Invention Paragraph (11):
[0009] FIG. 2 is a plan view of the electrode plate 101. Referring to FIG. 2, the electrode plate 101 has a plurality of gas nozzles (small holes) 120 and also functions as a showerhead that uniformly supplies the process gas to the processing zone 106.

Summary of Invention Paragraph (21):
[0019] In addition, because products produced by the reaction in the plasma deposit on components in the processing chamber, the components must be periodical cleaned or replaced with new ones. In particular, extremely high cleanness is required for the electrode plate 101 of the upper electrode 100, because it directly faces the semiconductor wafer 107.

Summary of Invention Paragraph (22):
[0020] Previously, a carbon or silicon electrode plate is used continuously to its life without cleaning it and then replaced with a new one, because the life of carbon or silicon electrode plate determined by the erosion is short. It was found that, however, the life of the carbon electrode plate is too short.

Summary of Invention Paragraph (25):

[0023] This inventor has also found that the reaction products deposited on a silicon electrode plate cannot be removed by cleaning methods that are used for cleaning components formed with other materials. Therefore, it was impossible to clean and re-use the silicon electrode plate after it is used until the reaction products are deposited and particles are generated. In other words, although the life, or the intrinsic life, of the silicon electrode plate determined by the erosion is long, the effective life is limited by the deposition of reaction products.

Summary of Invention Paragraph (29):
[0026] An object of the present invention is to provide a method of cleaning a component having small holes such as an electrode plate used in a plasma processing apparatus that can remove deposited layers formed within the small holes during the usage in the processing apparatus, so that the component can be re-used.

Summary of Invention Paragraph (30):
[0027] Another object of the present invention is to provide a method of producing semiconductor devices including re-using a component cleaned by the method of cleaning, so that the production cost and the consumption of natural resourced can be decreased.

Summary of Invention Paragraph (31):
[0028] In accordance with a method of the invention, an electrode plate used in a plasma processing apparatus is cleaned. The electrode plate has a plurality of gas nozzles through which a process gas is supplied to a processing zone of the plasma processing apparatus, the gas nozzles pass through an entire thickness of the electrode. The method includes immersing the electrode plate in an cleaning agent and removing deposited layers on inner walls of the gas nozzles formed when the electrode plate is used in the plasma processing apparatus, the removing includes radiating ultrasonic waves toward a surface of the electrode plate having openings of the plurality of gas nozzles from an ultrasonic wave radiation surface of a horn connected to an ultrasonic vibrator, a power density of the ultrasonic waves defined by a ratio of an electric power input to the ultrasonic vibrator to an area of the ultrasonic wave radiation surface being not lower than 5 W/cm.sup.2.

Summary of Invention Paragraph (32):
[0029] In accordance with another method of the invention, an electrode plate used in a plasma processing apparatus is cleaned. The electrode plate has a plurality of gas nozzles through which a process gas is supplied to a processing zone of the plasma processing apparatus, the gas nozzles pass through an entire thickness of the electrode plate. The method includes immersing the electrode plate in an cleaning agent and removing deposited layers on inner walls of the gas nozzles formed when the electrode plate is used in the plasma processing apparatus, the removing including producing a cavitation zone that extends through an entire depth of at the gas nozzles.

Summary of Invention Paragraph (33):
[0030] A method of producing semiconductor devices in accordance with the invention can include attaching an electrode plate in a plasma processing apparatus. The electrode plate has a plurality of gas nozzles through which a process gas is supplied to a processing zone of the plasma processing apparatus, the gas nozzles pass through an entire thickness of the electrode plate. The method of producing semiconductor devices can also include processing a first plurality of semiconductor devices in the processing zone while forming deposited layers on inner walls of the gas nozzles, detaching the electrode plate from the plasma processing apparatus and cleaning the detached electrode plate. The cleaning includes immersing the detached electrode plate in a cleaning agent and removing the deposited layers from inner walls of the gas nozzles, the removing including producing a cavitation zone extending through an entire depth of the gas nozzles. The method of producing semiconductor devices can further include re-attaching the cleaned electrode plate to the plasma apparatus and processing a second plurality of semiconductor devices in the plasma apparatus.

Summary of Invention Paragraph (34):
[0031] Finally, in accordance with another method of the invention, a component used in a plasma processing apparatus is cleaned. The component has a plurality of holes through which a process gas is supplied to a processing zone of the plasma processing apparatus, the holes pass through an entire thickness of the component. The method includes immersing the component in an cleaning agent and removing deposited layers on inner walls of the holes formed when the component is used in the plasma processing apparatus, the removing including producing a cavitation zone that extends through an entire depth of the holes.

Brief Description of Drawings Paragraph (6):
[0036] FIG. 4 is an exemplary schematic cross-sectional view of a cleaning apparatus for a cleaning method according to an embodiment of this invention;

Detail Description Paragraph (2):
[0041] Before explaining the preferred embodiments, results of analysis of deposited layers on inner walls of gas nozzles of the silicon electrode plate and unsuccessful efforts to remove the deposited layers by conventional cleaning methods will be explained.

Detail Description Paragraph (7):
[0046] The CF.sub.x polymer layers are also formed on other components that attached in the processing chamber 200 and are exposed to the plasma generated in the processing zone. As described in Japanese Unexamined Patent Application Publication No. 2002-231699, however, this inventor has found that the structure of the CF.sub.x polymer layers formed on such components is different from that of the CF.sub.x polymer layers 121 formed on the inner walls of the gas nozzles 120.

Detail Description Paragraph (8):
[0047] Components exposed to the plasma other than the upper electrode plate 101 are mainly composed of quartz or anodized aluminum. The CF.sub.x polymer layers formed on the surfaces of these components can be readily removed with fluorinated organic solvent by swelling. On the other hand, the CF.sub.x polymer layers 121 in the gas nozzle 120 are not substantially swelled in the fluorinated organic solvent. Thus, the CF.sub.x polymer layer 121 in the gas nozzles 120 cannot be removed with the fluorinated organic solvent that is generally used for cleaning components in plasma reaction chambers.

Detail Description Paragraph (12):
[0051] Because of this structural difference, fluorinated organic solvent cleaning, which is generally used for cleaning components in plasma processing chambers, cannot be used as a cleaning method for the electrode plate 101 having gas nozzles 120.

Detail Description Paragraph (13):
[0052] Another method generally used for removing the CF.sub.x polymer layer is the dry cleaning using plasma generated with a cleaning gas atmosphere. The dry cleaning method is effective for portions that are effectively exposed to the plasma. However, the dry cleaning method is not effective for the inner walls of the gas nozzles 120 that are not effectively exposed to the plasma.

Detail Description Paragraph (14):
[0053] Therefore, in order to clean the silicon electrode plate, other cleaning methods were examined.

Detail Description Paragraph (15):
[0054] Now, the preferred embodiments of the method of cleaning a component and the method of producing semiconductor devices will be described with reference to the accompanying drawings.

Detail Description Paragraph (16):
[0055] FIG. 4 is an exemplary schematic cross-sectional view of a cleaning apparatus used for the method of cleaning the component according to this invention. In the following embodiment, a silicon electrode plate 101 shown in FIG. 2 is used as an example of the component subjected to the cleaning.

Detail Description Paragraph (17):
[0056] Referring to FIG. 4, the cleaning apparatus has a cleaning vessel 10 provided with electrode clamps 11. The cleaning vessel 10 is filled with a cleaning solvent 12, for example, pure water. The electrode clamps 11 hold peripheral portions of a silicon electrode plate 101. An ultrasonic vibrator 1 is placed above the cleaning vessel 10 and is connected to a horn 2 with a connector 3 provided therebetween. The leading end 2a of the horn 2 is placed in the solvent 12 such that the leading end 2a is in proximity to the upper surface of the silicon electrode plate 101.

Detail Description Paragraph (21):
[0060] Before placing the electrode plate 101, the vessel 10 was filled with pure water 12 and the ultrasonic vibrator 1 was operated. Vigorous generation of bubbles was observed over a depth corresponding to or exceeding the thickness of the electrode plate within the range of ultrasonic power density that exhibits a cleaning effect, as

described below. In other words, a cavitation zone, or a zone where cavitation occurs was produced such that the zone extends over an entire area corresponding to the thickness of the electrode plate.

Detail Description Paragraph (22):
[0061] When the silicon electrode plate 101 was placed and irradiated with ultrasonic waves, bubbles vigorously belching from openings of the gas nozzles 120 at the surface opposite to the irradiating surface of the electrode plate 101 were observed. Accordingly, radiation of ultrasonic waves with the power density that exhibits the cleaning effect produces a cavitation zone extending through the entire depth of the gas nozzles 120, or, over the entire region from the openings at the irradiated surface of the electrode plate 101 to the other openings at the other surface.

Detail Description Paragraph (23):
[0062] For cleaning the silicon electrode plate 101 in the cleaning apparatus shown in FIG. 4, the ultrasonic vibrator 1 is scanned across the radial direction S, while producing the cavitation zone in the pure water 12 across the entire thickness of the silicon electrode plate 101. Thereby, all of the gas nozzles 120 are cleaned.

Detail Description Paragraph (25):
[0064] It was found that the CF.sub.x polymer layers 121 formed in the gas nozzles 120, which cannot be removed with a fluorinated organic solvent, could be removed by the cleaning method according to this invention. In this cleaning method shown in FIG. 4, the ultrasonic power density defined by the ratio of the input electric power to the ultrasonic vibrator 1 to the area of the leading end (ultrasonic wave radiation surface) 2a of the horn 2 is at least 5 W/cm.sup.2. Thereby, a cavitation zone extending over the entire region across the thickness of the silicon electrode 101, which is effective for removing the CF.sub.x polymer layers 121 in the gas nozzles 120, is produced.

Detail Description Paragraph (26):
[0065] An ultrasonic power density of less than 5 W/cm.sup.2 does not produce a sufficient physical cleaning effect that is necessary for removing the CF.sub.x polymer layers 121 deposited on the inner walls of the gas nozzles 120 of the silicon electrode plate 101.

Detail Description Paragraph (27):
[0066] The upper limit of the ultrasonic power density has not yet confirmed. In practice, the upper limit is preferably 35 W/cm.sup.2. For obtaining an ultrasonic power density exceeding 35 W/cm.sup.2, the area of the leading end 2a of the horn 2 must be minimized, resulting in a reduced cleaning area at a selected position of the ultrasonic vibrator 1. As a result, the ultrasonic vibrator 1 should be scanned for a significantly long time for cleaning the entire silicon electrode plate 101. Furthermore, erosion on the component may occur during the cleaning depending on the material used to construct the component.

Detail Description Paragraph (29):
[0068] In this embodiment, the cleaning solvent 12 is preferably pure water. The temperature of the pure water 12 is preferably in the range of 40.degree. C. to 60.degree. C. The immersion depth of the horn 2 in the cleaning solvent is preferably in the range of 5 to 15 mm.

Detail Description Paragraph (30):
[0069] The distance between the leading end 2a of the horn 2 and the surface of the silicon electrode plate 101 is preferably 3 mm or less. Such a short distance ensures a higher cleaning effect. The leading end 2a of the horn 2 cannot be in contact with the silicon electrode 101. Thus, the distance between the leading end 2a and the surface of the silicon electrode plate 101 must be larger than the amplitude of the leading end 2a. Because the amplitude of the leading end 2a is about 30 .mu.m in this embodiment, the distance must be larger than 30 .mu.m.

Detail Description Paragraph (31):
[0070] Preferably, the silicon electrode plate 101 is placed such that the leading end 2a of the horn 2 faces the surface 101a at which gas nozzles 120 diverge. The cavitation zone readily enters the gas nozzles 120 to enhance the cleaning effect. In addition to the cleaning from the surface 101a, cleaning from the other surface of the silicon electrode plate 101 further enhances the cleaning effect.

Detail Description Paragraph (32):

[0071] It was found that higher ultrasonic power densities improve the cleaning effect. Therefore, the cleaning mechanism is explainable by the steam cavitation effect, i.e., a physical effect by high-pressure impulse waves generated when the bubbles in the cavitation zone disappear. If the ultrasonic energy directly effects the cleaning, a large number of bubbles generated by the cavitation would preclude propagation of the ultrasonic energy and thus would decrease the cleaning effect.

Detail Description Paragraph (35):
[0074] For further improving the cleaning effect, another cleaning step may be utilized in combination with the cleaning by the cavitation.

Detail Description Paragraph (36):
[0075] As described in Japanese Unexamined Patent Application Publication No. 2002-231699, this inventor also examined various chemical and physical cleaning methods. As explained before, the ultrasonic cleaning according to this invention itself utilizes a physical effect produced by the cavitation. Therefore, as the physical cleaning method to be combined with the ultrasonic cleaning, methods other than ultrasonic cleaning were examined.

Detail Description Paragraph (37):
[0076] As for the chemical cleaning, cleanings with some acidic chemical solutions were found to be effective to some extent. In particular, immersion in buffered hydrofluoric acid solution (an aqueous solution including 6 wt % hydrofluoric acid and 30 wt % ammonium fluoride) or a hydrofluoric-nitric acid solution (an aqueous solution including 1 wt % hydrofluoric acid, 50 wt % nitric acid and 30 wt % glacial acetic acid) were found to be effective to remove the CF.sub.x polymer layers 121 in the gas nozzles 120 of a silicon electrode plate.

Detail Description Paragraph (39):
[0078] However, such chemical cleaning has drawbacks. That is, cleaning with solutions that etch silicon enlarges the diameter of the gas nozzles and increases microroughness on the inner walls of the gas nozzles 120. Such enlargement of the gats nozzles and increase of microroughness may alter the etching characteristics. In addition, different chemical solutions should be selected for components with different materials.

Detail Description Paragraph (40):
[0079] As for the physical cleaning, some kinds of blast cleanings such as sand blasting or dry honing were found to be effective to some extent. In particular, a blast cleaning using dry ice pellets was found to be effective to remove the CF.sub.x polymer layers 121 in the gas nozzles 120 of a silicon electrode plate.

Detail Description Paragraph (41):
[0080] In contrast with the cleaning with chemicals that etch silicon, the blast cleaning does not etch or otherwise damage silicon. That is, neither of the increase of the diameter nor the increase of microroughness on the inner walls of the gas nozzles formed in a silicon electrode plate was observed.

Detail Description Paragraph (42):
[0081] However, the cleaning effect of the blast cleaning is limited. That is, the blast cleaning cannot remove the CF.sub.x polymer layers 121 along the entire depths of the gas nozzles 120 formed in a 5 mm thick silicon electrode plate. In particular, although the pellets are blasted from both of the surfaces of the electrode plate, the CF.sub.x polymer layer 121 is remained around a certain position near the opening of the gas nozzle that is not enlarged.

Detail Description Paragraph (44):
[0083] As explained above, the effect of the blast cleaning is limited. However, a combination of the cleaning with cavitation and the blast cleaning was found to be effective. In particular, it was found that the blast cleaning could remove the CF.sub.x polymer layers 121 that partially remained after the cleaning utilizing the cavitation.

Detail Description Paragraph (45):
[0084] That is, although the cavitation cleaning can remove most of the CF.sub.x polymer layer 121 in the gas nozzles, there are cases that CF.sub.x polymer layers 121 remain in small portions within the gas nozzles. The remained CF.sub.x polymer layers 121, or residues, are partially separate from the inner walls of the gas nozzles 120 after the cavitation cleaning. Thus, during the blast cleaning, pellets entering the

gas nozzles 120 effectively blast and facilitate separation of the remained CF.sub.x polymer layers 121. Accordingly, cleaning in the gas nozzles 120 is further improved.

Detail Description Paragraph (46):
[0085] The blast cleaning is preferably performed from the surface 101a of the electrode plate 101 having enlarged openings of the nozzles 120 through which the pellets readily enter. More preferably, the blast cleaning is also performed from other surface.

Detail Description Paragraph (48):
[0087] The cleaning method according to this invention can also remove other contaminants as well as the CF.sub.x polymer layers 121. The cleaning method can also remove depositions on components other than the silicon electrode plate 101. During the cleaning step, the horn 2 is scanned across the radial direction S in this embodiment. If the long side (perpendicular to the direction S) of the horn 2 is smaller than the region where the gas nozzles 120 are formed, the horn 2 may be scanned several times. If the long side of the horn 2 is the same as the radius of the silicon electrode 101, the horn 2 may be rotated clockwise or counterclockwise over the silicon electrode 101.

Detail Description Paragraph (49):
[0088] In the embodiment, a silicon electrode plate 101 having gas nozzles 120 is cleaned utilizing the cavitation. The diameter of the gas nozzles is typically 0.5 mm. However, the diameter of the gas nozzles may range from about 0.3 mm to about 0.8 mm. The cleaning method utilizing the cavitation is effective to clean electrode plates having gas nozzles with the diameter in at least this range.

Detail Description Paragraph (50):
[0089] The cleaning method according to this invention is also applicable to electrode plates constructed with other materials such as carbon and anodized aluminum. Further, the cleaning method is applicable to various other components having small holes. For example, in an inductively coupled plasma processing apparatus such as shown in U.S. Pat. No. 5,863,376, a gas distribution plate, which also acts as a dielectric window to introduce RF power into the chamber, is used. Such gas distribution plate also has a plurality of small holes to distribute a process gas into the processing zone, and may be cleaned by the cleaning method according to this invention.

Detail Description Paragraph (51):
[0090] The holes are preferably pass through an entire thickness of the component, or, more preferable, straightly pass through the entire thickness of the component. Thereby, the inner surfaces of the small holes are effectively cleaned by the cavitaion generated across the entire thickness of the component.

Detail Description Paragraph (52):
[0091] Next, the method of producing semiconductor devices according to this invention will be described. This method includes a step of cleaning a component of a plasma processing apparatus for processing semiconductor devices by the above-described method of cleaning, in order to repeatedly use the component. The component that is cleaned and re-used is, for example, the silicon electrode plate 101 shown in FIG. 2.

Detail Description Paragraph (54):
[0093] In the method of producing semiconductor devices according to this invention, the timing for the cleaning may be appropriately determined. For example, for the silicon electrode plate 101 shown in FIG. 2, formation of particles becomes noticeable when the accumulated time of RF discharge reaches about 150 hours. Therefore, the silicon electrode plate 101 may be cleaned at, for example, an accumulated time of about 100 hours.

Detail Description Paragraph (55):
[0094] The cleaned component having small holes is repeatedly used in the present invention. The number of the particles produced in the reaction zone of the plasma processing apparatus can be reduced to the level essentially same as that in the case of using a new component. Thus, the plasma processing apparatus maintains the initial performance, or production yield, without replacing the component with a new one. Furthermore, reduction of number of necessary replacement components reduces the production cost saves natural resources.

Detail Description Paragraph (56):
[0095] Now, examples according to the cleaning method and production method of this

invention will be explained in detail.

Detail Description Paragraph (58):
[0096] Firstly, the dependence of the cleaning effect on the ultrasonic power density is measured.

Detail Description Paragraph (59):
[0097] A carbon electrode plate, and a silicon electrode plate are prepared and used in the dry etching apparatus shown in FIG. 1 for 100 hours (carbon electrode plate) or 150 hours (silicon electrode plate) of accumulated RF discharge time. An anodized aluminum electrode is also prepared and used in a cathode-coupled parallel-pate type etching apparatus for 100 hours. Each electrode plate has an outer diameter of 280 mm and a thickness of 5 mm, and has gas nozzles with a diameter of 0.5 mm that are arranged at a pitch of 7 mm. Each of the used electrode plates is placed in the cleaning apparatus shown in FIG. 4 such that the surface 101a of the electrode plate, which faces the semiconductor wafer in the etching apparatus, faces the horn 2. And ultrasonic waves are applied to the electrode plates through the horn 2.

Detail Description Paragraph (64):
[0102] After the ultrasonic cleaning, each electrode plate is finally cleaned in pure water for 10 minutes and then in isopropyl alcohol for 10 minutes. Ultrasonic waves with a frequency of 25 kHz and the power density of 0.5 W/cm.sup.2 are applied during these final cleaning steps. As will be explained later, this power density is far smaller than the range found to be effective to remove the CF.sub.x polymer layers 121. Therefore, the final cleaning itself is not considered to be effective to remove the CF.sub.x polymer layers 121.

Detail Description Paragraph (65):
[0103] After the final cleaning, each electrode is cut to expose the cross-sections of the gas nozzles 120. The cut surface is observed by scanning electron microscopy (SEM) to see if the CF.sub.x polymer layers 121 are removed or remained. The results are shown in FIG. 5 that is an exemplary graph illustrating the relationship between the cleanliness and the ultrasonic power density. The cleanliness at the vertical axis indicates the ratio of the gas nozzles from which the CF.sub.x polymer layers 121 are completely removed in twenty observed gas nozzles 120.

Detail Description Paragraph (66):
[0104] As shown in FIG. 5, for electrode plates of carbon or anodized aluminum, the cleaning effect (removal of the CF.sub.x polymer layers) is observed at an ultrasonic power density of 5 W/cm.sup.2 or more. And a high cleanliness of 95% or more is observed at an ultrasonic power density of 13 W/cm.sup.2 or more. For silicon electrode plates, the cleaning effect is observed at 8 W/cm.sup.2 or more, and a high cleanliness of 90% or more is observed at an ultrasonic power density of 18 W/m.sup.2 or more. These results show that cleaning effects are achieved at a threshold ultrasonic power density or more, although the threshold power density varies with the material of the electrode plate.

Detail Description Paragraph (68):
[0106] The cavitation zone that extends across the entire thickness (5 mm) of the electrode plate is observed at an ultrasonic power density of 5 W/cm.sup.2, at which the cleaning effect is observed for carbon and anodized aluminum alloy electrode plates. Therefore, the cavitation must be produced through the entire depth of the gas nozzles to remove the CF.sub.x polymer layers deposited on the inner walls of the gas nozzles.

Detail Description Paragraph (69):
[0107] Further, a higher ultrasonic power density is required to achieve a sufficiently high cleanliness. The higher ultrasonic power density increases the bubble density in the cavitation zone and increases the cleaning ability.

Detail Description Paragraph (70):
[0108] When the ultrasonic power density is within the range where the high cleanliness is obtained, the CFx polymer layers are almost completely removed even in the gas nozzles where residues of the CFx polymers layers are observed. That is, small residues of the CFx polymer layers that are partially removed are observed at random locations. There is no indication that the cleaning effect reaches only to a certain depth from the irradiated surface. Therefore, similarly high cleanliness would be achieved for gas nozzles in a thicker electrode plate.

Detail Description Paragraph (71):
[0109] After cleaning at an ultrasonic power density exceeding 35 W/cm.sup.2, erosion is observed on the surface of an anodized aluminum electrode plate, particularly in the vicinity of openings of the gas nozzles. No erosion is observed on the carbon and silicon electrode plates at an ultrasonic power density exceeding 35 W/cm.sup.2. However, it is necessary to reduce the area of the leading end 2a of the horn 2 in order to increase the ultrasonic power density above 35 W/cm.sup.2, resulting in a longer time for cleaning the entire electrode plate. Furthermore, such a high ultrasonic power density exceeding 35 W/cm.sup.2 causes severe vibration of the horn 2 that limits the continuous operation of the cleaning process.

Detail Description Paragraph (73):
[0111] In EXAMPLE 1, only one surface of the electrode plate is irradiated with ultrasonic waves. Additional irradiation from the other surface will further facilitate the cleaning.

Detail Description Paragraph (74):
[0112] Concerning ultrasonic cleaning using a horn, Japanese Unexamined Patent Application Publication No. 8-243616 discloses a method of enhancing the cleaning effect. In this method, the square of the ultrasonic wavelength in the cleaning solvent is controlled to be less than the area of the ultrasonic radiation surface of the horn. According to experiments by this inventor, however, such a relationship was not observed. In fact, with the horn 2 used in this example, at a frequency of 15 kHz, the square of the ultrasonic wavelength is larger than the area of the leading end 2a, which is the ultrasonic radiation surface.

Detail Description Paragraph (75):
[0113] Therefore, the shape and the size of the horn 2 can be determined depending on a required power intensity and a shape of the workpiece to be cleaned, including the cases that the square of the ultrasonic wavelength is larger than the area of the leading end 2a. For example, as in this example, the leading end 2a of the horn 2 can be made narrow and long and the horn 2 can be scanned perpendicularly to the longitudinal direction. Thereby, the area that can be cleaned by one scanning step is maximized. As a result, the scanning mechanism of the cleaning apparatus can be simplified.

Detail Description Paragraph (77):
[0114] In EXAMPLE 2, the removal effect of the CFx polymer layer is evaluated by combining the cavitation cleaning method with a physical cleaning method.

Detail Description Paragraph (78):
[0115] Electrode plates of which the cleanliness is not 100% in EXAMPLE 1 are subjected to a physical cleaning step. And the removal effect of the CF.sub.x polymer layers 121 is examined.

Detail Description Paragraph (80):
[0117] After the ultrasonic cleaning, a physical cleaning, namely, a blast cleaning is performed with dry ice pellets. The dry ice pellets have a diameter of 0.3 mm and are prepared by roller pulverization. The dry ice pellets are discharged with an air pressure of 8 kg/cm.sup.2 (780 kPa) to form a pellet stream. The both surfaces of the electrode plate are irradiated, one at a time, with the pellet stream at a rate of 5 seconds per gas nozzle.

Detail Description Paragraph (81):
[0118] Next, the final cleaning is performed as in EXAMPLE 1. The inner walls of the gas nozzles 120 are observed as in EXAMPLE 1 to evaluate the cleanliness. The cleanliness of all of the carbon, anodized aluminum, and silicon electrode plates is 100%. The CFx polymer layers and the intermediate layers are completely removed from the inner walls of the gas nozzles 120. From this result, the effectiveness of the combination of the cavitation cleaning and the physical cleaning is confirmed.

Detail Description Paragraph (83):
[0120] In the blast cleaning, the pellet stream is preferably directed perpendicular to the surface of the electrode plate, in other words, parallel to the depth of the gas nozzles 120, so that the pellets can reach the deep portions in the small holes. In this case, the pellet stream becomes almost parallel to the inner wall of each gas nozzle 120. Therefore, the blast cleaning alone is not effective to remove CFx polymer layers at the deep portions within the gas nozzles 120.

Detail Description Paragraph (84):
[0121] In this example, however, the blast cleaning is made after the ultrasonic cleaning with a power density sufficient to produce a cavitation zone through the entire depth of the gas nozzles 120. The pellets in the stream parallel to the depth of the gas nozzles 120 blast partially removed CFx polymer layers and intermediate layers remained after the ultrasonic cleaning, and carry the detached layers out of the gas nozzle 120. Accordingly, high cleanliness is achieved.

Detail Description Paragraph (85):
[0122] With an appropriate controlling of the discharge pressure, the blast cleaning does not have an etching effect on the base materials, i.e., carbon, anodized aluminum alloy, or silicon. Therefore, the physical cleaning does not cause increase of the diameter of the gas nozzles 120. Further, no increase of microroughness on the inner walls of the gas nozzles 120 or on the surface 101a and the rear surface of the electrode plate occurs.

Detail Description Paragraph (87):
[0123] As an example of the method of producing semiconductor devices according to this invention, silicon dioxide films (hereinafter referred to as SiO.sub.2 films) were etched using an electrode plate cleaned by the cleaning method according to this invention.

Detail Description Paragraph (90):
[0126] FIG. 6 is an exemplary partial cross-sectional view of the semiconductor device etched in the dry etching apparatus. The semiconductor wafer 107 shown in FIG. 1 has a SiO.sub.2 film 21 with a thickness of 1.0 .mu.m on a silicon substrate 20, as shown in FIG. 6. The SiO.sub.2 film 21 is covered with a photoresist film 22 with a thickness of 1.2 .mu.m. The photoresist film 22 has holes 23 with a diameter of 0.25 .mu.m.

Detail Description Paragraph (93):
[0129] The silicon electrode plate 101 was cleaned with an ultrasonic power density of 24 W/cm.sup.2. The frequency of the ultrasonic waves was 15 kHz, the area of the leading end 2a (ultrasonic radiating surface) of the horn 2 was 37.5 cm.sup.2, and the input electric power was 900 W. The cleaning solvent was pure water with a temperature of 50.degree. C. The distance between the leading end 2a of the horn 2 and the surface of the electrode plate 101a was 3 mm and the depth in the water of the leading end 2a of the horn 2 was 10 mm. The silicon electrode plate 101 was irradiated with ultrasonic waves for 10 minutes per gas nozzle. That is, each gas nozzle was exposed to the cavitation zone that extends through an entire depth of the gas nozzle for 10 minutes.

Detail Description Paragraph (94):
[0130] The silicon electrode plate 101 was subjected to a final ultrasonic cleaning in pure water for 10 minutes and then in isopropyl alcohol for 10 minutes, at an ultrasonic frequency of 28 kHz and an ultrasonic power density of 0.5 W/cm.sup.2. The silicon electrode plate 101 was dried by high-pressure nitrogen blowing and then by heating in a clean oven at 60.degree. C. for 6 hours.

Detail Description Paragraph (97):
[0133] There is no meaningful difference in the number of particles in periods before (0 to 100 hours) and after (100-200 hours) the cleaning of the silicon electrode plate 101. This result shows that the cleanliness of the silicon electrode plate 101 is recovered to a level essentially the same as that of the new one by the cleaning method according to this invention utilizing the ultrasonic cleaning.

Detail Description Paragraph (102):
[0138] In EXAMPLE 3, the silicon electrode plate 101 was cleaned once and used until 200 hours of accumulated discharge time. However, it is also possible to clean the silicon electrode plate 101 twice or more times using the cleaning method according to this invention, and to further extend the effective life of the silicon electrode plate 101 to more than 200 hours of accumulated discharge time.

Detail Description Paragraph (104):
[0139] In this example, cleaning of the silicon electrode plate 101 was made as in EXAMPLE 3 except that the blast cleaning was performed as in EXAMPLE 2 after the ultrasonic cleaning. The dry etching apparatus, the silicon electrode plate, the semiconductor device to be processed, and the dry etching process were the same as those in EXAMPLE 3.

Detail Description Paragraph (106):

[0141] There is no meaningful difference in the number of particles in periods before (0 to 100 hours) and after (100-200 hours) the cleaning of the silicon electrode plate. The results show that the cleanliness of the silicon electrode plate 101 is recovered to the level essentially the same as that of the new one by the cleaning method according to this invention utilizing the ultrasonic cleaning followed by the blast cleaning.

Detail Description Paragraph (108):
[0143] Moreover, as can be seen by comparing FIGS. 7 and 8, the increase in the particle counts during the period of the accumulated RF discharge time of 150 to 200 hours is moderated in EXAMPLE 4 compared with the case of EXAMPLE 3. This result shows that the combination of the ultrasonic cleaning and the blast cleaning further improves the cleanliness of the electrode plate and suppresses the generation of particles.

CLAIMS:

1. A method of cleaning an electrode plate used in a plasma processing apparatus, the electrode plate having a plurality of gas nozzles through which a process gas is supplied to a processing zone of the plasma processing apparatus, the gas nozzles passing through an entire thickness of the electrode plate, the method comprising: immersing the electrode plate in an cleaning agent; and removing deposited layers on inner walls of the gas nozzles formed when the electrode plate is used in the plasma processing apparatus, the removing including radiating ultrasonic waves toward a surface of the electrode plate having openings of the plurality of gas nozzles from an ultrasonic wave radiation surface of a horn connected to an ultrasonic vibrator, a power density of the ultrasonic waves defined by a ratio of an electric power input to the ultrasonic vibrator to an area of the ultrasonic wave radiation surface being not lower than 5 W/cm.sup.2.

2. The method according to claim 1, wherein a square of a wavelength of the ultrasonic wave in the cleaning agent is larger than the area of the radiation surface.

8. A method of cleaning an electrode plate used in a plasma processing apparatus, the electrode plate having a plurality of gas nozzles through which a process gas is supplied to a processing zone of the plasma processing apparatus, the gas nozzles passing through an entire thickness of the electrode plate, the method comprising: immersing the electrode plate in an cleaning agent; and removing deposited layers on inner walls of the gas nozzles formed when the electrode plate is used in the plasma processing apparatus, the removing including producing a cavitation zone that extends through an entire depth of the gas nozzles.

13. A method of producing semiconductor devices, comprising: attaching an electrode plate in a plasma processing apparatus, the electrode plate having a plurality of gas nozzles through which a process gas is supplied to a processing zone of the plasma processing apparatus, the gas nozzles passing through an entire thickness of the electrode plate; processing a first plurality of semiconductor devices in the processing zone while forming deposited layers on inner walls of the gas nozzles; detaching the electrode plate from the plasma processing apparatus: cleaning the detached electrode plate, the cleaning comprising: immersing the detached electrode plate in a cleaning agent; and removing the deposited layers from inner walls of the gas nozzles, the removing including producing a cavitation zone extending through an entire depth of the gas nozzles; re-attaching the cleaned electrode plate to the plasma apparatus; and processing a second plurality of semiconductor devices in the plasma apparatus.

20. A method of cleaning a component used in a plasma processing apparatus, the component having a plurality of holes through which a process gas is supplied to a processing zone of the plasma processing apparatus, the holes passing through an entire thickness of the component, the method comprising: immersing the component in an cleaning agent; and removing deposited layers on inner walls of the holes formed when the component is used in the plasma processing apparatus, the removing including producing a cavitation zone that extends through an entire depth of the holes.

23. The method according to claim 20, wherein said producing of the cavitation zone includes radiating ultrasonic waves toward a surface of the component having openings of the plurality of holes from an ultrasonic radiation surface of a horn connected to an ultrasonic vibrator, a power density of the ultrasonic waves defined by a ratio of an electric power input to the ultrasonic vibrator to an area of the ultrasonic wave radiation surface is not lower than 5 W/cm.sup.2.

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☐ 1. Document ID: US 20030150476 A1

L15: Entry 1 of 10 File: PGPB Aug 14, 2003

PGPUB-DOCUMENT-NUMBER: 20030150476
PGPUB-FILING-TYPE: new
DOCUMENT-IDENTIFIER: US 20030150476 A1

TITLE: Method of cleaning component in plasma processing chamber and method of producing semiconductor devices

PUBLICATION-DATE: August 14, 2003

INVENTOR-INFORMATION:

NAME	CITY	STATE	COUNTRY	RULE-47
Suzuki, Katsunori	Mihama-ku		JP	

US-CL-CURRENT: 134/1

ABSTRACT:

A component having small holes, such as a silicon electrode plate having gas nozzles, used in a plasma processing apparatus is cleaned by producing a cavitation zone that extends through an entire depth of the holes so that deposited layers on the inner walls of the holes formed during the use in the apparatus are removed. The cleaned component can subsequently be re-used in the apparatus, and the production cost and the consumption of natural resources are decreased.

Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | Claims | KMC | Draw Desc | Image

☐ 2. Document ID: US 20030136428 A1

L15: Entry 2 of 10 File: PGPB Jul 24, 2003

PGPUB-DOCUMENT-NUMBER: 20030136428
PGPUB-FILING-TYPE: new
DOCUMENT-IDENTIFIER: US 20030136428 A1

TITLE: Cleaning process residues on a process chamber component

PUBLICATION-DATE: July 24, 2003

INVENTOR-INFORMATION:

NAME	CITY	STATE	COUNTRY	RULE-47
Krogh, Ole	Belmont	CA	US	

US-CL-CURRENT: 134/28; 134/30, 134/41

ABSTRACT:

A method of cleaning process residues from the surface of a substrate processing

chamber component having holes. In the method, the component is at least partially immersed into a cleaning solution comprising hydrofluoric acid and nitric acid, and a non-reactive gas is passed through the holes to prevent the cleaning solution from back-flowing into the holes during the cleaning process. The method is particularly useful for cleaning sputtering residue deposits from an electrostatic chuck used in a sputtering process.

Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | Claims | KWIC | Draw Desc | Image

3. Document ID: US 20030020928 A1

L15: Entry 3 of 10 File: PGPB Jan 30, 2003

PGPUB-DOCUMENT-NUMBER: 20030020928
PGPUB-FILING-TYPE: new
DOCUMENT-IDENTIFIER: US 20030020928 A1

TITLE: Methods and apparatus for processing microelectronic workpieces using metrology

PUBLICATION-DATE: January 30, 2003

INVENTOR-INFORMATION:

NAME	CITY	STATE	COUNTRY	RULE-47
Ritzdorf, Thomas L.	Kalispell	MT	US	
Eudy, Steve L.	Kalispell	MT	US	
Wilson, Gregory J.	Kalispell	MT	US	
McHugh, Paul R.	Kalispell	MT	US	
Weaver, Robert A.	Kalispell	MT	US	
Aegerter, Brian	Kalispell	MT	US	
Dundas, Curt	Kalispell	MT	US	
Peace, Steven L.	Kalispell	MT	US	

US-CL-CURRENT: 356/630

ABSTRACT:

A method and apparatus for processing a microelectronic workpiece using metrology. The apparatus can include one or more processing or transport units, a metrology unit, and a control unit coupled to the metrology unit and at least one of the processing or transport units. The control unit can modify a process recipe or a process sequence of the processing unit based on a feed forward or a feed back signal from the metrology unit. The control unit can also provide instructions to the transport unit to move the workpiece to a selected processing unit. The processing unit can include, inter alia, a seed layer deposition unit, a process layer electrochemical deposition unit, a seed layer enhancement unit, a chemical mechanical polishing unit, and/or an annealing chamber arranged for sequential processing of a workpiece. The processing units can be controlled as an integrated system using one or more metrology units, or a separate metrology unit can provide input to the processing units.

Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | KWIC | Draw Desc | Image

4. Document ID: US 20020187594 A1

L15: Entry 4 of 10 File: PGPB Dec 12, 2002

PGPUB-DOCUMENT-NUMBER: 20020187594
PGPUB-FILING-TYPE: new
DOCUMENT-IDENTIFIER: US 20020187594 A1

TITLE: Method of manufacturing a semiconductor device

PUBLICATION-DATE: December 12, 2002

INVENTOR-INFORMATION:

NAME	CITY	STATE	COUNTRY	RULE-47
Yamazaki, Shunpei	Tokyo		JP	
Nakajima, Setsuo	Kanagawa		JP	
Miyairi, Hidekazu	Kanagawa		JP	

US-CL-CURRENT: 438/166; 438/476, 438/479, 438/486, 438/487

ABSTRACT:

After crystallization of a semiconductor film is performed by irradiating first laser light (energy density of 400 to 500 mJ/cm.sup.2) in an atmosphere containing oxygen, an oxide film formed by irradiating the first laser light is removed. It is next performed to irradiate second laser light under an atmosphere that does not contain oxygen (at a higher energy density than that of the first laser light irradiation), thus to increase the flatness of the semiconductor film.

Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments   KWIC | Draw Desc | Image

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☐ 5. Document ID: US 20020151154 A1

L15: Entry 5 of 10   File: PGPB   Oct 17, 2002

PGPUB-DOCUMENT-NUMBER: 20020151154
PGPUB-FILING-TYPE: new
DOCUMENT-IDENTIFIER: US 20020151154 A1

TITLE: Heat treatment apparatus and heat treatment method

PUBLICATION-DATE: October 17, 2002

INVENTOR-INFORMATION:

NAME	CITY	STATE	COUNTRY	RULE-47
Yamazaki, Shunpei	Tokyo		JP	
Ohtani, Hisashi	Kanagawa		JP	
Arai, Yasuyuki	Kanagawa		JP	

US-CL-CURRENT: 438/502

ABSTRACT:

An object is to provide a method of activating impurity elements added to a semiconductor film, and a method of gettering, in a process of manufacturing a semiconductor device using a substrate having a low resistance to heat, such as glass without changing the shape of the substrate, by using a short time heat treatment process. Another object is to provide a heat treatment apparatus that makes this type of heat treatment process possible. A unit for supplying a gas from the upstream side of a reaction chamber, a unit for heating the gas in the upstream side of the reaction chamber, a unit for holding a substrate to be processed in the downstream side of the reaction chamber, and a unit for circulating the gas from the downstream side of the reaction chamber to the upstream side are prepared. The amount of electric power used in heating the gas can be economized by circulating the gas used to heat the substrate to be processed. A portion of the circulating gas may be expelled, and can be utilized as a heat source in order to preheat a newly introduced gas.

Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | KWIC | Draw Desc | Image

6. Document ID: US 20020066717 A1

L15: Entry 6 of 10 File: PGPB Jun 6, 2002

PGPUB-DOCUMENT-NUMBER: 20020066717
PGPUB-FILING-TYPE: new
DOCUMENT-IDENTIFIER: US 20020066717 A1

TITLE: Apparatus for providing ozonated process fluid and methods for using same

PUBLICATION-DATE: June 6, 2002

INVENTOR-INFORMATION:

NAME	CITY	STATE	COUNTRY	RULE-47
Verhaverbeke, Steven	San Francisco	CA	US	
DiBello, Gerald N.	West Chester	PA	US	

US-CL-CURRENT: 216/13; 118/722

ABSTRACT:

The present invention is directed to apparatus and methods for wet processing electronic components using ozonated process fluids. In the apparatus and methods of the present invention, the ozonated process fluid is provided by an apparatus having a vessel for containing a stock fluid; an ozone source connected to the vessel for supplying ozone to the vessel; a fluid source in fluid communication with the vessel for supplying a fluid to the vessel; and a back-pressure regulator connected with an exhaust for regulating pressure within the vessel.

Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | KWIC | Draw Desc | Image

7. Document ID: US 20020033186 A1

L15: Entry 7 of 10 File: PGPB Mar 21, 2002

PGPUB-DOCUMENT-NUMBER: 20020033186
PGPUB-FILING-TYPE: new
DOCUMENT-IDENTIFIER: US 20020033186 A1

TITLE: Processes and apparatus for treating electronic components

PUBLICATION-DATE: March 21, 2002

INVENTOR-INFORMATION:

NAME	CITY	STATE	COUNTRY	RULE-47
Verhaverbeke, Steven	San Francisco	CA	US	
Liu, Lewis	Paoli	PA	US	
Walter, Alan	Chester Springs	PA	US	
Sheen, C. Wade	Chester Springs	PA	US	
McConnell, Christopher	Berwyn	PA	US	

US-CL-CURRENT: 134/26; 134/95.1

ABSTRACT:

A process for treating an electronic component wherein the electronic component is

exposed to a heated solvent and subsequently exposed to an ozonated process fluid. The electronic component is optionally exposed to the heated solvent by exposing the electronic component to a passing layer of heated solvent. An apparatus for treating electronic components with a heated solvent and an ozonated process fluid is also provided.

Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments   KWIC | Draw Desc | Image

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8. Document ID: US 6491763 B2

L15: Entry 8 of 10 File: USPT Dec 10, 2002

US-PAT-NO: 6491763
DOCUMENT-IDENTIFIER: US 6491763 B2

TITLE: Processes for treating electronic components

DATE-ISSUED: December 10, 2002

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Verhaverbeke; Steven	San Francisco	CA		
Liu; Lewis	Paoli	PA		
Walter; Alan	Chester Springs	PA		
Sheen; C. Wade	Chester Springs	PA		
McConnell; Christopher	Berwyn	PA		

US-CL-CURRENT: 134/26; 134/2, 134/3, 134/30, 134/31

ABSTRACT:

A process for treating an electronic component wherein the electronic component is exposed to a heated solvent and subsequently exposed to an ozonated process fluid. The electronic component is optionally exposed to the heated solvent by exposing the electronic component to a passing layer of heated solvent. An apparatus for treating electronic components with a heated solvent and an ozonated process fluid is also provided.

51 Claims, 6 Drawing figures
Exemplary Claim Number: 1
Number of Drawing Sheets: 5

Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments   KWIC | Draw Desc | Image

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9. Document ID: US 6127279 A

L15: Entry 9 of 10 File: USPT Oct 3, 2000

US-PAT-NO: 6127279
DOCUMENT-IDENTIFIER: US 6127279 A

TITLE: Solution applying method

DATE-ISSUED: October 3, 2000

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Konuma; Toshimitsu	Kanagawa			JP

US-CL-CURRENT: 438/745; 257/E21.251, 257/E21.309, 257/E21.313, 438/753

ABSTRACT:

In etching using an etching solution, irradiating ultraviolet light is irradiated into a resist patterned on an etching substrate or a film formed on the etching substrate and then an etching solution is applied to the etching substrate while rotating the etching substrate. Also, ozone water is applied in contact with the resist and then an etching solution is applied to the etching substrate while rotating the etching substrate. In crystallization using a metal element such as nickel for promoting crystallization of silicon, irradiating ultraviolet light is irradiated into a resist patterned on an substrate or a film formed on the substrate and then a nickel solution is applied to the substrate while rotating the substrate. Also, ozone water is applied in contact with the resist and then the nickel solution is applied to the substrate while rotating the substrate.

11 Claims, 15 Drawing figures
Exemplary Claim Number: 1
Number of Drawing Sheets: 6

Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments   KWIC | Draw Desc | Image

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☐ 10. Document ID: WO 2003061859 A1 US 20030136428 A1
L15: Entry 10 of 10   File: DWPI   Jul 31, 2003

DERWENT-ACC-NO: 2003-709897
DERWENT-WEEK: 200367

TITLE: Process residues cleaning method, involves partially immersing electrostatic chuck component into cleaning, and passing non-reactive gas through holes at high pressure

INVENTOR: KROGH, O

PRIORITY-DATA: 2002US-0056299 (January 23, 2002)

PATENT-FAMILY:

PUB-NO	PUB-DATE	LANGUAGE	PAGES	MAIN-IPC
WO 2003061859 A1	July 31, 2003	E	000	B08B003/04
US 20030136428 A1	July 24, 2003		006	B08B003/04

INT-CL (IPC): B08 B 3/04; B08 B 3/08; C23 C 16/44

Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments   KWIC | Draw Desc | Image

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HOLE	1454526
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(L14 AND HOLES).USPT,PGPB,JPAB,EPAB,DWPI,TDBD.	10